

Claims

1. Flow measuring method for the measurement of velocity in a single-phase or multi-phase flow, such as a multi-phase flow in a process pipe or similar, **characterized in** measuring
 5 two consecutive values of pressure p, temperature T and momentum D, then to calculate the change in pressure Δp , change in temperature ΔT and change in momentum ΔD , where the method further comprises the steps of calculating the velocity U after the following formula:

$$\Delta D = -U^2 \Delta \rho + \frac{1}{2} U^2 \Delta \rho = -\frac{1}{2} U^2 \Delta \rho \quad (5)$$

- 10 where $\Delta \rho$ is expressed as

$$\Delta \rho = -\frac{R_{mix} T}{p^2} \Delta p + \frac{R_{mix}}{p} \Delta T \quad (2)$$

where R_{mix} is the universal gas constant.

2. Method according to claim 1, **characterized in** that the method further comprises the
 15 step of measuring the pressure p, the temperature T and the momentum D in the proximity of each other in the process pipe.

3. Method according to claim 1 or 2, **characterized in** that the method further comprises
 20 the step of measuring the pressure p, the temperature T and the momentum D at the same time.

4. A flow measuring device for measuring different parameters in a single-phase or multi-phase flow in a process pipe or process tank or similar, where a probe (1) comprises a housing (2) in a first end (1A) and sensors in a second end (1b), where the housing (2)
 25 comprises a flange (21) able to be fastened to a pipe nipple in the process pipe or the process tank, and where the housing (2) preferably comprises electronic components connected to the different sensors in the probe (1) to perform the measurements and then to calibrate and transfer the measured results to a central monitoring unit, where the probe (1) further comprises a long, hollow momentum tube (3) fastened by its first end (3A) to the
 30 housing (2), where the second end (3B) of the momentum tube (3) is inserted into the process pipe or process tank, and where the probe (1) further comprises a hollow cylindrical sensor tube (4) located inside the momentum tube (3) and fastened by a first end (4A) thereof to the first end (3A) of the momentum tube (3), where the sensor tube (4) comprises plate capacitors (CA1, CA2, CA3, CA4) located on the outside of the second
 35 end (4B), thereby being able to measure the conductance between the momentum tube (3)

and the plate capacitors (CA1, CA2, CA3, CA4) on the sensing tube (4), **characterized in** that the probe comprises a pressure sensor and a temperature sensor.

5. Probe according to claim 4, **characterized in** that the pressure sensor and the
5 temperature sensor are encapsulated in, or inserted in, a pressure and temperature unit located in the second end (3B) of the momentum tube (3).

6. Probe according to claim 4, **characterized in** that the probe in its second end further comprises an erosion sensor (5) known per se.

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7. Probe according to claim 6, **characterized in** that the erosion sensor comprises a pressure and temperature unit. (7).

AMENDED CLAIMS

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1. Flow measuring method for the measurement of velocity in a single-phase or multi-phase flow, such as a multi-phase flow in a process pipe or similar, **characterized in** measuring
 5 two consecutive values of pressure p, temperature T and momentum D, then to calculate the change in pressure Δp , change in temperature ΔT and change in momentum ΔD , where the method further comprises the steps of calculating the velocity U after the following formula:

$$\Delta D = -\frac{1}{2} U^2 \Delta \rho \quad (5)$$

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where $\Delta \rho$ is expressed as

$$\Delta \rho = -\frac{R_{mix} T}{p^2} \Delta p + \frac{R_{mix}}{p} \Delta T \quad (2)$$

where R_{mix} is the universal gas constant.

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2. Method according to claim 1, **characterized in** that the method further comprises the step of measuring the pressure p, the temperature T and the momentum D in the proximity of each other in the process pipe.
- 20 3. Method according to claim 1 or 2, **characterized in** that the method further comprises the step of measuring the pressure p, the temperature T and the momentum D at the same time.
4. A flow measuring device for measuring different parameters in a single-phase or multi-
 25 phase flow in a process pipe or process tank or similar, where a probe (1) comprises a housing (2) in a first end (1A) and sensors in a second end (1b), where the housing (2) comprises a flange (21) able to be fastened to a pipe nipple in the process pipe or the process tank, and where the housing (2) preferably comprises electronic components connected to the different sensors in the probe (1) to perform the measurements and then to
 30 calibrate and transfer the measured results to a central monitoring unit, where the probe (1) further comprises a long, hollow momentum tube (3) fastened by its first end (3A) to the housing (2), where the second end (3B) of the momentum tube (3) is inserted into the process pipe or process tank, and where the probe (1) further comprises a hollow cylindrical sensor tube (4) located inside the momentum tube (3) and fastened by a first end
 35 (4A) thereof to the first end (3A) of the momentum tube (3), where the sensor tube (4) comprises plate capacitors (CA1, CA2, CA3, CA4) located on the outside of the second

end (4B), thereby being able to measure the conductance between the momentum tube (3) and the plate capacitors (CA1, CA2, CA3, CA4) on the sensing tube (4), **characterized in** that the probe comprises a pressure sensor, a temperature sensor and a momentum sensor.

5 5. Probe according to claim 4, **characterized in** that the pressure sensor and the temperature sensor are encapsulated in, or inserted in, a pressure and temperature unit located in the second end (3B) of the momentum tube (3).

6. Probe according to claim 4, **characterized in** that the probe in its second end further
10 comprises an erosion sensor (5) known per se.

7. Probe according to claim 6, **characterized in** that the erosion sensor comprises a pressure and temperature unit (7).

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